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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

# TECHNICAL REPORT

# ON

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

# FOR

# LUGGAGE-HARDWARE ASSEMBLER (hardware) 6-93.404

# B-398 or S-136



U. S. Employment Service in
Cooperation with the
New Jersey State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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GATB #2193
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# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR LUGGAGE-HARDWARE ASSEMBLER 6-93.404

B-398 or S-136

## Summary

The General Aptitude Test Battery, B-1002A, was administered to 51 women employed as Luggage-Hardware Assembler 6-93.404 at the Presto Lock Company, Garfield, New Jersey. The criterion consisted of supervisory ratings made on a descriptive rating scale. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K-Motor Coordination, F-Finger Dexterity, and M-Manual Dexterity were selected for inclusion in the test norms.

## GATB Norms for Luggage-Hardware Assembler 6-93.404 - B-398 or S-136

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Luggage-Hardware Assembler 6-93.404.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-398 or S-136

| B-1001 | | | B-1002 | | |
|---|---|---|---|---|---|
| Aptitude | Tests | Minimum Acceptable Aptitude Score | Aptitude | Tests | Minimum Acceptable Aptitude Score |
| T | CB-1-G<br>CB-1-K | 75 | K | Part 8 | 80 |
| F | CB-1-O<br>CB-1-P | 90 | F | Part 11<br>Part 12 | 85 |
| M | CB-1-M<br>CB-1-N | 80 | M | Part 9<br>Part 10 | 80 |

## Effectiveness of Norms

The data in Table IV indicate that 13 of the 18 poor workers, or 72 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 72 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 28 of the 33 workers who made qualifying test scores, or 85 percent, were good workers.

TECHNICAL REPORT

## I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Luggage-Hardware Assembler 6-93.404.

## II. Sample

The General Aptitude Test Battery, B-1002A, was administered during the month of August 1957 to 51 women employed as Luggage-Hardware Assembler 6-93.404 at the Presto Lock Company, Garfield, New Jersey. This number represented approximately 41 percent of the total plant population in this classification. Workers were selected from the group on a voluntary basis. The sample group was analyzed by management to assure that it was representative of the classification as a whole.

The job is a semi-skilled occupation involving the assembly of hardware components or complete units by hand, spot-welding machine, or punch press. Workers must be able to perform all the hand and machine operations.

The selection of applicants is made on the basis of a personal interview. There are no rigid age, education, or experience requirements. The company prefers workers between the ages of 18 to 45 with an eighth grade education and some previous assembly experience; but will hire inexperienced applicants who can speak, read, and write English. Training time for this occupation is one month.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations ($\sigma$), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Luggage-Hardware Assembler 6-93.404
N = 51

| | M | $\sigma$ | Range | r |
|---|---|---|---|---|
| Age (years) | 34.9 | 6.7 | 23-52 | -.072 |
| Education (years) | 9.3 | 2.0 | 5-14 | .034 |
| Experience (months) | 89.1 | 59.1 | 6-228 | .115 |

There are no significant correlations with the criterion for age, education or experience. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education, and experience.

III. Job Description

Job Title: Luggage-Hardware Assembler 6-93.404

Job Summary: Assembles component parts of luggage hardware by hand and by use of punch press and spot-welding machine to make luggage locks, key plates, hinges, lock-snaps and clasps. Manipulates assembled items to test smoothness of operation.

Work Performed: Manually assembles subassemblies. Selects required pieces from hoppers. Positions pieces in proper sequence in holding fixture located on work table, fitting each piece correctly over the preceding piece. Visually inspects pieces for defects. May move pieces through grease to assure more efficient functioning. Removes assembled pieces from fixture manually, or releases pedal of air-ejector which forces compressed air against the assembled piece, thus ejecting the assembly from the fixture.

Welds luggage hardware parts, using spot-welding machine. Places first part in die of spot-welding machine with right hand, and positions and holds second part over the first with left hand. Presses micro-switch button with right hand to activate spot-welding machine. Removes welded assembly and repeats operation.

Clinches luggage hardware parts, using punch press. Places parts to be secured in die of press, and activates press by simultaneously pressing two micro-switches (one with each hand). Removes assembled parts manually, or by air-ejection.

Tests and packs luggage hardware. Manipulates assembled hinges and clasps, and inserts and turns keys in locks to assure proper functioning. Rejects imperfect pieces and packs perfect pieces by inserting them in packing cards.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion used for this study consisted of supervisory ratings made on a Descriptive Rating Scale. The scale consisted of nine items covering different aspects of job performance. Each item had five alternative statements regarding the adequacy of performance. Independent ratings were made by the first and second line supervisors for each worker, and the product-moment correlation between the two sets of ratings was computed. The obtained correlation of .84 indicated substantial agreement between the two sets of ratings. The final criterion consisted of a combination of the two sets of ratings. The distribution of the combined ratings ranged from 38 to 82 with a mean criterion score of 56.7 and a standard deviation of 9.5. The reliability of the combined ratings as estimated by the Separman-Brown prophecy formula was .91.

## VI. Statistical and Qualitative Analyses

### A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations ($\sigma$), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Luggage-Hardware Assembler 6-93.404
N = 51

| Aptitudes | M | $\sigma$ | r |
|---|---|---|---|
| G-Intelligence | 82.1 | 15.3 | .168 |
| V-Verbal Aptitude | 87.4 | 13.2 | .174 |
| N-Numerical Aptitude | 83.0 | 17.6 | .209 |
| S-Spatial Aptitude | 81.5 | 17.3 | .119 |
| P-Form Perception | 88.7 | 18.2 | .399** |
| Q-Clerical Perception | 102.6# | 19.8 | .307* |
| K-Motor Coordination | 97.3# | 16.5 | .377** |
| F-Finger Dexterity | 103.8# | 18.3 | .449** |
| M-Manual Dexterity | 102.0# | 19.2 | .507** |

** Significant at the .01 level
* Significant at the .05 level
# Highest Mean Scores

### B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Form Perception (P) - required for visually inspecting pieces for conformity to specifications.

Motor Coordination (K) - required for synchronizing the positioning of parts to be assembled by machine and the activation of the switches which control the operation of the machines, and for operating the air-ejector mechanism.

Finger Dexterity (F) - required for picking up, handling, and manually assembling small parts; picking up and placing small parts in jigs of spot-welding machine and punch press; manipulating pieces to determine whether they function smoothly; and for packing parts on packing cards.



Manual Dexterity (M) - required for assembling sub-assemblies; activating punch press, spot-welding machine, and air-ejector; and for manually removing assembled pieces from machines.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes P, K, F, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

| Aptitude | Relatively High Mean | Significant Correlation with Criterion | Importance Indicated by Qualitative Analysis |
|---|---|---|---|
| P | | X | X |
| K | X | X | X |
| F | X | X | X |
| M | X | X | X |

Although there is statistical evidence to warrant preliminary consideration of Aptitude Q for inclusion in the test norms, it did not appear to be sufficiently important on the basis of job analysis data to warrant further consideration.

Various combinations of Aptitudes P, K, F, and M, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII) was determined. A comparison of the results showed that norms consisting of K-80, F-85, and M-80 for B-1002 and equivalent norms of T-75, F-90, and M-80 for B-1001 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within five points of one standard deviation below the aptitude mean of the sample.

## VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing approximately one-third of the sample in the low criterion group. This was accomplished by setting a criterion critical score of 52 which resulted in 18 of the 51 workers, or 35 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes K, F, and M with critical scores of 80, 85, and 80, respectively, and the dichotomized criterion for Luggage-Hardware Assembler 6-93.404. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes K, F, and M with Critical Scores of 80, 85, and 80, Respectively, and the Criterion for Luggage-Hardware Assembler 6-93.404

N = 51

| | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 5 | 28 | 33 |
| Poor Workers | 13 | 5 | 18 |
| Total | 18 | 33 | 51 |

$r_{tet} = .79$ $\quad X^2 = 14.206$

$\sigma_{r_{tet}} = .23$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

## VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K, F, and M with minimum scores of 80, 85, and 80, respectively, are recommended as B-1002 norms for the occupation of Luggage-Hardware Assembler 6-93.404. The equivalent B-1001 norms consist of T-75, F-90, and M-80.

## IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-17, which consists of K-85, F-80, and M-80 for B-1002 and T-80, F-85, and M-85 for B-1001. The selective efficiency of OAP-17 for this sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .69 with a standard error of .23 was obtained, which indicates a significant relationship between OAP-17 and the criterion for this experimental sample. The proportion of the sample screened out by OAP-17 was .41, which is within the required range of .40 to .60. Therefore, it is recommended that OAP-17 be used in counseling for the occupation of Luggage-Hardware Assembler 6-93.404.